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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/759,925	01/16/2004	Kiyoshi Satoh	ASMJP.055C1	8224

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EXAMINER	
KORNAKOV, MICHAIL	
ART UNIT	**PAPER NUMBER**
1746	

SHORTENED STATUTORY PERIOD OF RESPONSE	NOTIFICATION DATE	DELIVERY MODE
3 MONTHS	02/05/2007	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Notice of this Office communication was sent electronically on the above-indicated "Notification Date" and has a shortened statutory period for reply of 3 MONTHS from 02/05/2007.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/759,925	SATOH ET AL.	
	Examiner	Art Unit	
	Michael Kornakov	1746	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *10 November 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,11 and 40-54* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,11 and 40-54* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *11/10/2006*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. Applicants' amendment dated 11/10/2006 is acknowledged. Claims 44-54 are new. Claims 1, 11, 40-54 are currently pending and examined on the merits.

2. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

3. Claims 1, 11, 40-45, 54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Subrahmanyam et al (U.S. 6,079,424) in view of Smith et al (U.S. 6,150,628) and in further view of Fong et al (U.S. 5,812,403).

Subrahmanyam teaches a method of cleaning a processing CVD chamber after conducting a wafer CVD processing comprising dissociating a cleaning gas within the remote plasma module 300 to produce activated plasma species; flowing activated plasma species from the remote plasma module to the processing CVD chamber through a piping 380, wherein the flow of plasma species through the piping 380 is not restricted; removing adhered deposits from the inside surfaces of CVD chamber (Fig. 2; col.6, lines 40-61; col.7, lines 1-10, 38-43; paragraph bridging col.7 and 8; col.8, lines 19-29).

While teaching the use of remote plasma module to dissociate fluorine containing corrosive gases, Subrahmanyam remains silent about material, the inside surfaces of remote plasma module is made offand specifically about anodized aluminum alloy, wherein the dissociated cleaning gas is exposed to anodized aluminum alloy wall of the remote plasma module. However, the use of anodize aluminum for the protection of inside surfaces of remote plasma

chambers against fluorine containing corrosive plasma species is known in the art. Thus, Smith teaches cleaning CVD chamber with fluorine containing plasma species produced within the remote plasma source, the inside surfaces of which are formed from a coated metal, such as anodized aluminum. Smith indicates the use of anodized aluminum as a material resistant to etching by plasma radicals within the remote plasma source (Abstract, col.2, lines 33-36,46-50; col.8, lines 56-61). Therefore, since both Subrahmanyam and Smith indicate the use of fluorine containing plasma species formed within the remote plasma sources and Smith provides for the use of anodized aluminum as the material resistant to fluorine containing plasma media, one skilled in the art motivated by Smith would have found obvious to utilize anodized aluminum as the material for remote module in order to maintain resistance of the remote module to fluorine containing plasma species in the teaching of Subrahmanyam with the reasonable expectation of success.

While teaching a flow of activated plasma species from the remote plasma module to the processing CVD chamber through the piping, wherein the flow of said species is not obstructed (Fig. 2), and recognizing the benefits of such flow (col.6, lines 58-61), Subrahmanyam remains silent about a step of opening a valve on the piping (and, therefore, the presence of such valve on the piping) after conducting a CVD reaction and prior to supplying activated species, wherein opening a valve comprises withdrawing a valve body completely from a path to form an opening substantially as wide as internal surfaces of the piping.

Fong teaches cleaning CVD chamber with remotely formed plasma,

wherein a gate valve 280 on the piping 47 between the remote plasma system 55 and the CVD chamber 15 is utilized in order to connect or disconnect CVD chamber from the cleaning system. Fong specifically indicates that gate valve 280 isolates the clean processes from the deposition processes. Gate valve 280 normally remains closed while chamber 15 is being used for deposition, reflow, or drive-in steps. In the closed position, gate valve 280 prevents particles in conduit 47 used for clean processes from contaminating the wafer during deposition processes, as well as reducing the "dead" volume of conduit 47 and passage during deposition. If deposition occurs with gate valve 280 open, deposition may be caused in applicator tube 292, leading to contamination of the cleaning processes. In embodiments using gate valve 280, only when chamber 15 is used for a wafer cleaning step or when a chamber cleaning is performed does gate valve 280 open, allowing plasma radicals to flow into fluid passage 293 of gas mixing box 273, as seen in FIG. 3 (col. 37, lines 38-59). Therefore, one skilled in the art, motivated by Fong, would have found obvious to utilize the gate valve of Fong in the teaching of Subrahmanyam in order to prevent deposition of residues and eliminate dead volume within the piping of Subrahmanyam during semiconductor processing, and operate the gate valve of Fong by its opening after conducting a CVD process and prior to supplying activated plasma species, as suggested by Fong, in order to provide unrestricted flow of plasma cleaning species into the CVD chamber in the cleaning method of Subrahmanyam. With regard to the limitation reciting "withdrawing a valve body completely from a path to form an opening substantially as wide as internal

surfaces of the piping", it is noted that gate valves are specifically designed to be fully opened or closed. When fully open, the typical gate valve has no obstruction in the flow path, resulting in very low friction loss. Therefore, the indicated limitation is met by Fong, who teaches the use of gate valve.

Regarding claim 11, Fong teaches closing the gate valve after cleaning (paragraph bridging col. 56 and 57; col.57).

With regard to claim 40, removal of silicon nitride deposits is specifically indicated by Subrahmanyam (col. 7, line 6).

With regard to claims 41, 43 fluorine containing gas (NF_3) with the flow rate corresponding to the instantly claimed values is indicated.

With regard to claim 44, which is concerned with "a straight-line section of piping", through which the activated species are solely directed or claim 54, which is concerned with "a straight-line structure between the remote plasma discharge chamber and the chemical vapor deposition reaction chamber", it is noted that such line section or structure represents a structural elements of the apparatus in method claim. However, the recitation of specific structural limitations of apparatus for performing the processing steps, wherein the steps of the process (namely, supplying activated species) are met by applied prior art, does not serve to limit the claim, consult ***In re Otto***, 312 F.2d 937, 938, 136 USPQ 458, 459 (CCPA 1963).

With regard to the claims 45 and 54, which are concerned with "pressure loss at the piping and at the valve", since the method of Subrahmanyam is practiced under vacuum conditions, established by continuous operation of the

vacuum pump during the chamber cleaning, this limitation of claims 45 and 54 ("no appreciable pressure loss in the piping and at the valve") are inherently met by Subrahmanyam/Fong.

With regard to energy frequency, as per the instant claim 42, Subrahmanyam teaches adjusting and finding the proper processing parameters for particular cleaning application (paragraph, bridging col.11 and 12). It is noted that the criticality of the indicated energy frequency range is not emphasized by Applicants. Since energy frequency is result effective parameter, affecting formation of plasma species and the output of the cleaning process, discovery of optimum value of result effective variable is within the skills of the ordinarily skilled in the art and would have been obvious.

With regard to claims 46-48, 50, 51 Subrahmanyam teaches CVD chamber cleaning process wherein silicon oxide and silicon nitride residues are removed from chamber surfaces by plasma species formed from carbon tetrafluoride or nitrogen trifluoride (col.7, lines 6-20), Subrahmanyam remains silent about the value of energy applied in the remote module. However, Subrahmanyam refers to US'834 to Tanaka, which is incorporated by reference in the teaching of Subrahmanyam (col.6, lines 30-39), wherein the preferred embodiment related to similar CVD chamber cleaning process with a remotely generated plasma is provided and wherein applying microwave power of about 1.5 kW (reads on "less than 3000 W" as claimed) is indicated (col. 12, lines 38-45). As to the limitation of claim 46, reciting that removing the adhered deposits occurs at a rate of greater than or equal to about 2.0 microns/minute, it is noted

that one who performs the steps of the known process must necessarily produce all of its advantages. Mere recitation of a newly discovered function or property, that is inherently possessed by things in the prior art **does not cause a claim** drawn to these things to distinguish over the prior art, consult In Re Leinoff v. Louis Milona & Sons, Inc. 220 USPQ 845 (CAFC 1984). Therefore, the recited rate of removing the adhered deposits is possessed by the teaching of Subrahmanyam/Smith/Fong.

4. Claim 46 and dependent claims 49, 52, 53 are separately rejected under 35 U.S.C. 103(a) as being unpatentable over Subrahmanyam et al (U.S. 6,079,424) in view of Smith et al (U.S. 6,150,628) and in further view of Fong et al (U.S. 5,812,403) and in view of Pokharna et al (U.S. 6,358,327).

While teaching removal of silicon oxide and silicon nitride residues the teaching of Subrahmanyam/Smith/Fong, does not indicate removal of tungsten adhered deposits and also does not specifically indicate the energy threshold in the remote plasma module as 3000W, or the energy being in the range between about 2,500W and 3,000W. The general teaching of US'834, incorporated in the teaching of Subrahmanyam indicates power suppliers to generate typically between about 2.5-6kW microwave power in the remote module. Pokhara teaches similar cleaning operation wherein tungsten is cleaned from the surfaces of the CVD chamber by plasma species generated in remote microwave generator, which is operated between about 1500W to about 3000W. Therefore, since both Subrahmanyam/Smith/Fong and Pokharna are concerned with the cleaning of CVD processing chambers utilizing the same remotely activated

cleaning gas (NF_3), since tungsten deposits represent the common residue left within the CVD chamber upon wafer processing and Pokharna teaches removal of tungsten deposits by plasma species generated under 1500W-3000W power range, one skilled in the art motivated by Pokharna would have found obvious to utilize the method of Subrahmanyam/Smith/Fong also to remove tungsten deposits by adjusting the energy applied in the remote module as suggested by Pokhara with the reasonable expectation of success.

With regard to claim 53, it is noted that the criticality of the indicated energy frequency range is not emphasized by Applicants. Since energy frequency is result effective parameter, affecting formation of plasma species and the output of the cleaning process, discovery of optimum value of result effective variable is within the skills of the ordinarily skilled in the art and would have been obvious.

Response to Arguments

5. Applicant's arguments filed 11/10/2006 have been fully considered but they are not persuasive. Applicants argue that "One of skill in the art would not interpret Subrahmanyam as teaching the desirability of a free and unobstructed flow between the remote chamber and the deposition chamber". This is not found persuasive since a free and unobstructed flow between the remote module and the CVD chamber is clearly presented by Fig. 2 of Subrahmanyam. Applicants' attention is drawn to MPEP, section 2125, which states that "When the reference is a utility patent, it does not matter that the feature shown is unintended or unexplained in the specification. The drawings must be evaluated for what they

reasonably disclose and suggest to one of ordinary skill in the art. In re Aslanian, 590 F.2d 911, 200 USPQ 500 (CCPA 1979). See MPEP § 2121.04 for more information on prior art drawings as "enabled disclosures." Therefore, an additional explicit recitation or suggestion of such "desirability" is apparently not required. However, Subrahmanyam states that "Positioning the remote plasma source module 300 so that the plasma flows into the chamber through the gas distribution manifold 11 produces a beneficial flow of plasma species" (col. 6, lines 58-61).

Applicants also argue that "none of the art (including Subrahmanyam) appears to recognize that the particular portion of the piping recited in the present claims (between the two chambers) should be unrestricted or that there could be some benefit gained by keeping this section unrestricted during cleaning". This in not found persuasive since, for example the references to Subrahmanyam, Fong, Pokharna (Fig. 2) show portion of piping wherein the flow of plasma species is unrestricted.

The next Applicants' argument is that "item 380 is a "manifold." Applicants provide the definition of manifold as a "pipe or chamber having multiple apertures for making connections." Applicants conclude that "it is clear that item 380 is not meant to be a literal depiction of the structure of the piping". This is not found persuasive, since "pipe having multiple apertures" is readable on the pipe having openings at each end of the pipe.

Applicants also sate that "Subrahmanyam is completely silent in regard to the exclusion of additional, standard, elements. Thus, one of skill in the art,

looking at the teaching of Figure 2 and the specification, would conclude that other aspects would be present in item 380 to the extent that they are routinely used in such a device". Applicants acknowledge that valves such as that recited (apparently, the gate valve of Fong, M.K.) existed at the time of the invention. However, Applicants state that there is no motivation to select the valve in Fong to result in the presently claimed method steps. This is not found persuasive since it is not clear why the conventional structural element (gate valve) can not be used within the teaching of Subrahmanyam to the extend the other conventional structural elements, as per Applicants statement, would be present. The motivation to use the gate valve of Fong in the teaching of Subrahmanyam is provided in this office action. Furthermore, Applicants are reminded that suggestion to modify the art to produce the claimed invention need not be expressly stated in one or all the references used to show obviousness, ***Cable Elec. Prods., Inc. v. Genmark, Inc.*** 770 F. 2d 1015, 226 USPQ 881,886 (Fed. Cir. 1985).

Applicants also argue that "at the time of filing, one of skill in the art assumed that flow restriction during cleaning was desirable (teaching away from the presently claimed embodiment). This is not found persuasive. In their argument Applicants for example are relying on "needle valve" of Shang (U.S. 5,788,778). However, the needle valve is specifically designed to partially restrict the flow, which is different from the gate valve, which is intended to be fully opened or closed. In operation, when fully open, the typical gate valve has no obstruction in the flow path, resulting in very low friction loss. Therefore,

Applicants are relying on the structural element, the intended use of which is different from the gate valve, the use of which was also known at the time the invention was made. The other references, cited by Applicants, also provide specific flow restrictive devices. However, Applicants attention is drawn to U.S. 6,358,327, which also constitutes the prior art of record and which teaches delivery of reactive radicals from plasma generator 212 directly into the process zone 238 (col.4, lines 18-22). Therefore, Applicants statement that "it is clear that, at the time of filing of the application, one of skill in the art would not have performed the presently recited step in the claimed combination because the art was focused on slowing, restricting, and controlling the flow in this area" is apparently without merits.

6. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will

the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael Kornakov whose telephone number is (571) 272-1303. The examiner can normally be reached on 9:00am - 5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Barr can be reached on (571) 272-1414. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

M. KORNAKOV

Michael Kornakov
Primary Examiner
Art Unit 1746

01/31/2007